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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/781,811	02/20/2004	Masatoshi Takami	042123	3939

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EXAMINER

RICHARDS, N DREW

ART UNIT	PAPER NUMBER
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2815

DATE MAILED: 10/17/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

<b>Office Action Summary</b>	<b>Application No.</b> 10/781,811	<b>Applicant(s)</b> TAKAMI, MASATOSHI	
	<b>Examiner</b> N. Drew Richards	<b>Art Unit</b> 2815	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 03 August 2006.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-15 and 21 is/are pending in the application.  
     4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-15 and 21 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
     Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
     Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All    b) ☐ Some    c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |  |   |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                       | 5) <input type="checkbox"/> Notice of Informal Patent Application                       |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

## **DETAILED ACTION**

### ***Election/Restrictions***

1. Applicant's election without traverse of Group I in the reply filed on 12/10/04 is acknowledged.

### ***Claim Rejections - 35 USC § 112***

2. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

3. Claims 1-15 and 21 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. Independent claim 1 has been amended to include the limitation "so that a fluctuation of a dispersion of hydrogen termination ratio of the interface is not more than 35% of that without the metal layer when the transistor is of N channel, and a dispersion of hydrogen termination ratio of the interface is not more than 85% of that without the metal layer when the transistor is of P channel" and independent claim 2 has been amended to include the limitation "so that a fluctuation of a dispersion of hydrogen termination ratio of the interfaces is not more than 35% of that without the first and second metal layers when the first and second transistors are of N channel, and a dispersion of hydrogen termination ratio of the interfaces is not more

than 85% of that without the first and second metal layers when the first and second transistors are of P channel.” It is not clear where in the specification as originally filed, support for these limitations can be found. Upon review of the originally filed specification no description or support for these limitations can be found. As such, these limitations were not described in the specification in such a way as to reasonably convey to one skilled in the art that the inventor(s) had possession of the claimed invention at the time the application was filed.

4. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

5. Claims 1-15 and 21 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claims 1 and 2 recite a percentage of fluctuation of dispersion of hydrogen termination ratio of the transistor compared to the transistor without the metal layer. This limitation renders the claims indefinite. First, it is not clearly understood what is meant by the “dispersion” of hydrogen termination or the “fluctuation” of the dispersion. It is not clear what these terms represent or how and where they are measured. For instance, is the “fluctuation” and “dispersion” determined by the amount of hydrogen termination in a certain region of the interface or only a part of the interface. The claims do not clearly and definitely define an amount of hydrogen termination, a dispersion of hydrogen termination, or a fluctuation of a dispersion. The specification as filed provides no

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support for these terms or measurements and does not provide any guidance as to their meaning or how they limit the scope of the claim.

Claims 3-15 and 21 depend from claims 1 and 2 and are thus also indefinite.

6. Insofar as definite, the claims are rejected over prior art as follows.

***Claim Rejections - 35 USC § 102/103***

7. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

9. Claims 1, 6, 8, 10, 12 and 14 rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over JP-09252131-A (cited on IDS submitted 3/29/04).

With regard to claim 1, JP-09252131-A discloses in figures 1-17 a semiconductor device comprising:

- a semiconductor substrate 10 having a device region (figure 5; the region encompassed by reference letter "T" is considered the device region);

- a transistor including a gate electrode G formed in the device region with a gate insulation film formed therebetween (figure 1 shows gate "G" labeled; though not labeled, the transistor has a gate dielectric as it is disclosed in the abstract as being a MOS transistor; MOS stands for "metal oxide semiconductor" and necessarily has a gate insulation film (oxide) formed under the gate); and
- a metal layer 16Q formed over the gate electrode with an insulation film 14 formed therebetween (figure 5), formed of a metal material having the property of occluding hydrogen and having a peripheral part 16C positioned outer of a region where the gate electrode and the device region overlap each other (figure 10 shows the composition of metal layer 16; the metal layer is formed of Titanium which occludes hydrogen; figure 5 shown the position of peripheral part 16C),
- hydrogen termination of an interface between the semiconductor substrate and the gate insulation film by hydrogen annealing being suppressed (the hydrogen termination during hydrogen annealing is suppressed by the metal layer 16Q).

JP-09252131-A does not explicitly recite that the fluctuation of a dispersion of hydrogen termination ratio of the interface is not more than 35% of that without the metal layer when the transistor is of N channel, and a dispersion of hydrogen termination ratio of the interface is not more than 85% of that without the metal layer when the transistor is of P channel. Nonetheless, since the structure of the reference is

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substantially identical to that of the claims, the structure of the reference is presumed to possess the claimed property. JP-09252131-A teaches the transistor structure, using the same materials and the same metal layer as presently claimed such that it is substantially identical to that of the claims and thus is presumed to inherently possess the same fluctuation of a dispersion of hydrogen termination ratio of the interface when N channel or the same dispersion of hydrogen termination ratio of the interface when P channel.

It is noted that applicant has the burden of showing that their claimed invention contains an unobvious difference from that of the prior art. See MPEP 2112, section V and MPEP 2112.01, section I.

With regard to claim 6, as seen in figures 7 and 11, the metal layer 16Q is not connected to any other conductive layers and thus the potential of the metal layer 16Q is floating.

With regard to claim 8, the ratio of the gap measured vertically between the metal layer 16Q and the substrate to the gap measured horizontally between the region where the gate electrode and the device region overlap each other and the peripheral part of the metal layer is 0.32 or less than 0.32. Though measurements are not shown for the gaps in the ratio, the structure as shown meets the claimed ratio. Further, with the broad "region" language of the claim, one can measure from the right side of the gate to the edge of peripheral portion 16C such that the ratio is roughly 1:4, which is less than 0.32.

With regard to claim 10, the metal layer of JP-09252131-A is disclosed in figure 10 as being formed of the metal material having the property of occluding hydrogen (Ti), and another metal film of a metal material which does not have the property of occluding hydrogen (Al).

With regard to claim 12, JP-09252131-A further disclose an interconnection layer 16S or 16D formed on the insulation film 14 and formed of the same metal film forming the metal layer 16Q.

With regard to claim 14, the metal material is titanium, magnesium, an alloy containing titanium or an alloy containing magnesium (Ti or TiN as shown in figure 10).

10. Claims 2, 7, 9, 11, 13, 15 and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over JP-09252131-A as applied to claims 1, 6, 8, 10, 12 and 14 above, and further in view of Lockwood (U.S. Patent No. 3,996,482).

Claim 2 recites a device having a first and second transistor, each transistor with the same limitations as the transistor in the device of claim 1. JP-09252131-A teaches a single transistor with all the claimed limitations of each individual transistor as shown above with regards to claim 1, however, JP-09252131-A does not teach two transistors in a single semiconductor device. It is well known in the semiconductor art to form multiple transistors together so that they may be interconnected into various circuits or arrays.

Lockwood teaches a circuit in figure 1 that includes multiple transistors 18/20/30/32/50/52/70 formed together using MOS LSI (large scale integration)



techniques. Lockwood shows an advantageous use for the transistor of JP-09252131-A in that it may be used in a current mirror circuit, inverter circuit, or bias network to produce a one shot multivibrator circuit.

JP-09252131-A and Lockwood are combinable because they are from the same field of endeavor. At the time of the invention it would have been obvious to a person of ordinary skill in the art to form a circuit such as Lockwood's using the transistor of JP-09252131-A. The motivation for doing so is to form an improved one shot multivibrator circuit where the period of its output pulse is independent of the threshold voltages of the transistors used in the circuit design. Therefore, it would have been obvious to combine JP-09252131-A with Lockwood to obtain the invention of claim 2. In combination, hydrogen termination would be suppressed at the interfaces between the substrate and both the first and second gate insulation films.

With regard to claim 7, as seen in figures 7 and 11 of JP-09252131-A, the metal layer 16Q is not connected to any other conductive layers and thus the potential of the metal layer 16Q is floating. In combination, either or both of the first and second metal layer is floating.

With regard to claim 9, the ratio of the gap measured vertically between the first metal layer 16Q and the substrate to the gap measured horizontally between the region where the gate electrode and the first device region overlap each other and the peripheral part of the metal layer is 0.32 or less than 0.32. Though measurements are not shown for the gaps in the ratio, the structure as shown meets the claimed ratio. Further, with the broad "region" language of the claim, one can measure from the right

side of the gate to the edge of peripheral portion 16C such that the ratio is roughly 1:4, which is less than 0.32.

With regard to claim 11, the first metal layer or the second metal layer of JP-09252131-A is taught in figure 10 as being formed of the metal material having the property of occluding hydrogen (Ti), and another metal film of a metal material which does not have the property of occluding hydrogen (Al).

With regard to claim 13, JP-09252131-A further teach an interconnection layer 16S or 16D formed on the insulation film 14 and formed of the same metal film forming the first metal layer or the second metal layer 16Q.

With regard to claim 15, in combining the references, the transistor of JP-09252131-A is used in the circuit shown in Lockwood figure 1, thus the transistor forms a part of a current mirror circuit.

With regard to claim 21, the ratio of the gap measured vertically between the second metal layer 16Q and the substrate to the gap measured horizontally between the region where the second gate electrode and the second device region overlap each other and the peripheral part of the metal layer is 0.32 or less than 0.32. Though measurements are not shown for the gaps in the ratio, the structure as shown meets the claimed ratio. Further, with the broad "region" language of the claim, one can measure from the right side of the gate to the edge of peripheral portion 16C such that the ratio is roughly 1:4, which is less than 0.32.

11. Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over JP-09252131-A as applied to claims 1, 6, 8, 10, 12 and 14 above, and further in view of Dixit et al. (US 2002/0185664 A1).

JP-09252131-A does not teach the potential of the metal layer being fixed to a prescribed potential. The metal layer 16Q of JP-09252131-A is formed on the first level of metallization along with the source/drain contacts 16S/16D but is not connected to any other conductive structures and is in fact a dummy layer in that it does not contribute to device operation.

Dixit et al. teach metallization layers in a large scale integrated circuit. Dixit et al. teach that dummy layers are included in circuits but have previously been left floating (Dixit et al., paragraphs 0007-0008). Dixit et al. teach connecting dummy metal to ground.

JP-09252131-A and Dixit et al. are combinable because they are from the same field of endeavor. At the time of the invention it would have been obvious to a person of ordinary skill in the art to form the metal layer 16Q of JP-09252131-A such that it's potential is fixed to a prescribed potential of ground. The motivation for doing so is to avoid unwanted cross-talk or noise in the chip. Therefore, it would have been obvious to combine JP-09252131-A with Dixit et al. to obtain the invention of claim 4.

12. Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over JP-09252131-A in view of Lockwood (U.S. Patent No. 3,996,482) as applied to claims 2, 7, 9, 11, 13 and 15 above, and further in view of Dixit et al. (US 2002/0185664 A1).

JP-09252131-A with Lockwood do not teach the potential of the metal layer being fixed to a prescribed potential. The metal layer 16Q of JP-09252131-A is formed on the first level of metallization along with the source/drain contacts 16S/16D but is not connected to any other conductive structures and is in fact a dummy layer in that it does not contribute to device operation.

Dixit et al. teach metallization layers in a large scale integrated circuit. Dixit et al. teach that dummy layers are included in circuits but have previously been left floating (Dixit et al., paragraphs 0007-0008). Dixit et al. teach connecting dummy metal to ground.

JP-09252131-A with Lockwood and Dixit et al. are combinable because they are from the same field of endeavor. At the time of the invention it would have been obvious to a person of ordinary skill in the art to form the first metal layer or the second metal layer 16Q of JP-09252131-A such that its potential is fixed to a prescribed potential of ground. The motivation for doing so is to avoid unwanted cross-talk or noise in the chip. Therefore, it would have been obvious to combine JP-09252131-A and Lockwood with Dixit et al. to obtain the invention of claim 5.

### ***Response to Arguments***

13. Applicant's arguments filed 8/3/06 have been fully considered but they are not persuasive.

Applicant has argued that JP-09252131-A does not teach the claimed property of hydrogen dispersion as recited in claims 1 and 2. This is not persuasive. The fact that

the reference is silent as to the claimed property does not preclude the structure of the reference from possessing the claimed property. In the instant case, since JP-09252131-A teaches the same structure as the transistor of the instant invention it follows that the structure of the JP-09252131-A transistor will have the same properties.

Applicant's argument that "it is probable" that the hydrogen termination of the reference is the same with the metal layer as without is not persuasive. This argument is mere speculation by the attorney and is not supported by any evidence on the record. Further, it is noted that JP-09252131-A in their invention sets their hydrogen anneal conditions so as to provide proper damage recovery (by hydrogen termination at the interface) to compensate for the existence of the hydrogen occluding metal layer. That is, since the metal layer occludes hydrogen JP-09252131-A adjusts the hydrogen anneal to provide more hydrogen to compensate for the hydrogen occluded by the metal layer. JP-09252131-A teaches in paragraphs [0008]-[0014] that using the prior art hydrogen anneal process the termination of dangling bonds (by hydrogen termination) is not made fully. JP-09252131-A solves this problem by adjusting the hydrogen anneal process. Thus, in the prior art device in JP-09252131-A, when the hydrogen annealing is performed, there is a suppressed hydrogen termination as compared to when the metal layer is not present in the same manner as in the present invention. The fact that JP-09252131-A performs an improved hydrogen anneal in their invention so as to sufficiently terminate the interface does not change the fact that they also teach that when the conventional hydrogen anneal is performed hydrogen termination is suppressed as claimed in the present invention.

***Conclusion***

14. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to N. Drew Richards whose telephone number is (571) 272-1736. The examiner can normally be reached on Monday-Friday 9:00-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ken Parker can be reached on (571) 272-2298. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.



**N. DREW RICHARDS**  
**PRIMARY EXAMINER**